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SPECIFICATION

ENDOSCOPIC FLUID SUPPLY CONDUIT SYSTEM

BACKGROUND OF THE INVENTION

Field of the Art

This invention relates to a fluid supply conduit system suitable for use on medical endoscopes in charging and discharging a fluid to and from a body cavity, and more particularly to an endoscopic conduit system capable of supplying a fluid selectively either from a fluid supply source connected to a fluid feed port on a manipulating head assembly of an endoscope or from a fluid supply source connected to a universal cable of the endoscope.

Prior Art

Generally, medical endoscopes are largely constituted by a manipulating head assembly to be gripped and manipulated by an operator for controlling various endoscopic operations, an elongated insertion tube connected to a front side of the manipulating head

1 assembly for insertion into a body cavity of a patient, and a universal
2 cable led out on the rear side of the manipulating head assembly. The
3 universal cable is disconnectibly connectible at least to a light source
4 to transmit illumination light to the fore distal end of the insertion
5 tube through a light guide. In addition to the light guide, various
6 channels and passages are provided internally of the endoscope.

7 As for example of internal passages or channels, in many cases
8 the so-called biopsy channel is provided in endoscopes to permit
9 insertion of forceps or other biopsy or surgical instruments. The
10 biopsy channel extends through the endoscope toward an exit opening
11 which is opened at the distal end of the insertion tube. Besides, a
12 suction channel is provided for aspiration of body fluids or the like.
13 Normally, a suction channel is provided within an endoscope in
14 communication with the biopsy channel. An aspirator with a vacuum
15 pump device is connected to the other proximal end of the suction
16 channel at the time of aspiration. A suction valve which is provided on
17 the manipulating head assembly of the endoscope is connected to the
18 suction channel, and manipulated by an operator at the time of
19 starting or ending aspiration.

1 Further, a cleaning fluid supply channel is provided in the
2 endoscope for the purpose of supplying cleaning fluids to be used in
3 cleaning or washing an observation window which is provided at the
4 fore distal end of the insertion tube. The cleaning fluid normally
5 consists of a cleaning liquid (normally cleaning water) and compressed
6 air. When an observation window is contaminated, a cleaning liquid is
7 spurted toward the observation window to wash away contaminants
8 therefrom. Thereafter, compressed air is supplied and blasted against
9 the observation window to remove droplets of the cleaning liquid.
10 Thus, for this purpose, a liquid feed channel and an air feed channel
11 are provided in the endoscope. An air/water feed valve which is
12 provided on the manipulating head assembly of the endoscope is
13 operated by an operator at the time of supplying a cleaning liquid and
14 compressed air to the liquid and air feed channels. The liquid feed
15 channel and the air feed channel are joined together in the vicinity of
16 the fore distal end of the insertion tube and connected to a spout
17 nozzle which is directed toward the observation window. The air/water
18 feed valve is put in a liquid feed position, whereupon a cleaning liquid
19 is supplied to the spout nozzle and spurted toward the observation

1 window. In the next place, the air/water feed valve is put in an air
2 feed position, whereupon a jet of compressed air is spurted out from
3 the nozzle. Thus, an observation window at the fore distal end of the
4 endoscopic insertion tube can be washed clean without necessitating
5 to extract the insertion tube each time when it is found contaminated.

6 Further, in addition to the channels for the observation window
7 cleaning operations, some endoscopes are provided with a fluid jet
8 injection channel for injecting a jet of water toward an intracavitary
9 wall under high pressure for washing purposes or for sprinkling a
10 pigment on an intracavitary wall or for feeding or circulating a cleaning
11 liquid to internal portions. Such a jet injecting channel is connected
12 to an injection port which is opened at the fore distal end of the
13 insertion tube to inject a cleaning water or a medicinal liquid.

14 In this connection, it has been the usual practice to employ a
15 pump for supplying a large quantity of fluids to the injection port of
16 the fluid jet injection channel from a supply tank. At this time, the
17 other end of the channel is connected to a fluid supply tank and a
18 pump. Since a universal cable is led out from the manipulating head
19 assembly, from the standpoint of maneuverability of the manipulating

1 head assembly, it is rather desirable to pass the fluid jet injection
2 channel through the universal cable. However, in some cases the
3 pump pressure is found insufficient to supply a fluid under a
4 predetermined pressure. In this regard, it has been known in the art
5 to boost the fluid supply pressure with a fluid from a syringe at the
6 time of injecting a fluid from a passage from a pressure feed means
7 which is connected to the fluid jet injection channel, for example, as
8 disclosed in Laid-Open Japanese Patent Application H11-32988.

9 The purposes of use of the fluid jet injection channel include not
10 only supply of a large quantity of a cleaning or wash water but also
11 supply of a small amount of a coloring matter or a pigment under high
12 pressure. At the time of supplying a required amount of a fluid under
13 high pressure, it is desirable to pump in the fluid from the side of the
14 manipulating head assembly by an operator using a syringe or a
15 similar pressure feed means. However, in the case of the above-
16 mentioned prior art, a syringe or a pressure feed means which is set
17 on the manipulating head assembly of the endoscope is used as an
18 auxiliary means for boosting the pressure of a fluid which is supplied
19 through a fluid supply channel on the side of the universal cable, and

1 not used as means for supplying a fluid from the side of manipulating
2 head assembly independently of a pump. It follows that other fluid
3 feed means becomes necessary for supplying a small amount of a
4 medicinal solution under high pressure. Namely, the fluid injection
5 channel of the above-mentioned prior art is not suitable for use in
6 such cases where a necessary amount of a fluid has to be supplied
7 under a certain pressure according to judgements of an operator.

8 SUMMARY OF THE INVENTION

9 With the foregoing situations in view, it is an object of the
10 present invention to provide an endoscopic fluid supply conduit system
11 which makes it possible to supply a fluid into a body cavity selectively
12 either from a fluid supply source which is detachably attached to a
13 manipulating head assembly of an endoscope or from a fluid supply
14 source which is connected to a universal cable of the endoscope.

15 It is another object of the present invention to provide an
16 endoscopic fluid supply conduit system which permits to supply a fluid
17 selectively through one of two supply channels, one of which supply
18 channels being suitable for use at the time of injecting a fluid into a
19 body cavity under uniform pressure and at a constant flow rate while

1 the other one being suitable for use in injecting a fluid under a
2 desired pressure and at a desired flow rate.

3 It is still another object of the present invention to provide an
4 endoscopic fluid supply conduit system which permits to supply a fluid
5 selectively either from a manipulating head assembly or from a
6 universal cable of an endoscope without increasing the diameter of the
7 insertion tube.

8 In accordance with the present invention, the above-stated
9 objectives are achieved by the provision of an endoscopic fluid supply
10 conduit system for an endoscope having an insertion tube and a
11 universal cable connected to and from a manipulating head assembly,
12 the fluid supply conduit system comprising: a first fluid conduit
13 extended from the manipulating head assembly and through the
14 insertion tube toward a fluid injection port provided on a rigid tip end
15 section at the fore distal end of the insertion tube; a fluid feed port
16 provided on the manipulating head assembly in communication with
17 the first fluid conduit and arranged to permit connection thereto of a
18 fluid feed adaptor; a second fluid conduit provided internally of the
19 universal cable and communicable with the first fluid conduit within

1 the manipulating head assembly; and a fluid supply channel selector
2 means adapted to block a fluid flow from the second fluid conduit to
3 the first fluid conduit at the time of feeding a fluid from the fluid feed
4 port to the first fluid conduit, while permitting a fluid flow from the
5 second fluid conduit to the first fluid conduit when the fluid feed port
6 is closed.

7 According to the present invention, two fluid supply channels
8 are provided internally of an endoscope to supply a fluid to a fluid jet
9 injection port which is opened on a rigid tip end section at the fore
10 distal end of the insertion tube of the endoscope. With the fluid
11 supply conduit system according to the present invention, it is possible
12 to select fluid supply either from a fluid feed port which is provided on
13 a manipulating head assembly of the endoscope or from and through a
14 universal cable of the endoscope. That is to say, the fluid supply
15 conduit system is provided with first and second fluid conduits which
16 can be selected by the fluid supply channel selector means. When a
17 fluid is fed into the first fluid conduit through the fluid connection
18 port, the supplied fluid is prevented from flowing into the second
19 fluid conduit. On the other hand, when a fluid is supplied to the

1 endoscope from the side of the second fluid conduit, the supplied fluid
2 is prevented from flowing out of the fluid feed port on the manipulating
3 head assembly of the endoscope.

4 In a preferred form of the present invention, the fluid supply
5 channel selector means is constituted by a mouth piece which is
6 fixedly fitted in the fluid feed port on the manipulating head assembly
7 of the endoscope, the mouth piece having a first connection port
8 provided at an inner axial end for connection of the first fluid conduit
9 and a second connection port provided at one side for connection of
10 the second fluid conduit. When a fluid feed adaptor is fitted into the
11 mouth piece, the second connection port is closed by the fluid feed
12 adaptor. When the fluid feed adaptor is removed from the mouth piece
13 and instead a plug member is fitted to close an outer open end of the
14 mouth piece, the first and second fluid conduits are communicated
15 with each other, permitting fluid supply from the second to the first
16 fluid conduit while preventing fluid leaks through the mouth piece.

17 In another preferred form of the present invention, the second
18 fluid conduit is joined with a halfway point of the first fluid conduit
19 within a casing of the manipulating head assembly, and a reverse flow

1 checking valve is inserted in the second fluid conduit at the junction
2 point with the first fluid conduit to prevent a fluid flowing in a reverse
3 direction toward the second fluid conduit from the side of the first fluid
4 conduit.

5 The above and other objects, features and advantages of the
6 present invention will become apparent from the following particular
7 description of the invention, taken in conjunction with the
8 accompanying drawings which show by way of example some preferred
9 embodiments of the present invention. Needless to say, the present
10 invention is not limited to the particular forms shown in the drawings.

11 BRIEF DESCRIPTION OF THE DRAWINGS

12 In the accompanying drawings:

13 Fig. 1 is a schematic illustration of an endoscope incorporating
14 an endoscopic fluid supply conduit system according to the present
15 invention;

16 Fig. 2 is a schematic sectional view of a fluid supply channel
17 selector means in a first embodiment of the present invention, with a
18 fluid feed adaptor fitted on the channel selector means;

19 Fig. 3 is a schematic sectional view of the channel selector

1 means of Fig. 2 and a plug member which is fitted on the channel
2 selector means;

3 Fig. 4 is a schematic sectional view of a forked junction pipe
4 member employed as a channel selector means in a second
5 embodiment of the present invention, the junction pipe member being
6 connected with first and second fluid conduits; and

7 Fig. 5 is a schematic sectional view of a mouth piece employed in
8 the second embodiment of the invention.

9 DESCRIPTION OF PREFERRED EMBODIMENTS

10 Hereafter, the present invention is described more particularly
11 by way of its preferred embodiments with reference to the
12 accompanying drawings. Referring first to Fig. 1, there is
13 schematically shown general layout of an endoscope. In this figure,
14 indicated at 1 is an insertion tube, at 2 a manipulating head assembly
15 and at 3 a universal cable of the endoscope. As well known in the art,
16 illumination and observation windows, an exit opening of a biopsy
17 channel and an observation window washing nozzle are provided at the
18 fore distal end of the insertion tube 1. In this case, the endoscope is
19 provided with a fluid jet injection system.

1 The fluid supply conduit system is provided internally of the
2 insertion tube 1 and the manipulating head assembly 2 of the
3 endoscope. The fluid supply conduit system includes a first fluid
4 conduit 4 which is extended internally through the insertion tube 1,
5 and a second fluid conduit 5 which is extended internally through the
6 universal cable and to the manipulating head assembly 2 of the
7 endoscope. Further, the second fluid conduit 5 is led out from a
8 connector portion 3a of the universal cable 3 and connected to a fluid
9 feed device 6, which is composed of a fluid supply tank and a pump. A
10 fluid supply channel selector means 7 is provided on the manipulating
11 head assembly 2 thereby to select a fluid supply channel between a
12 first supply channel which supplies a specified fluid from the
13 manipulating head assembly 2 through the first conduit 4 and a
14 second supply channel which supplies a specified fluid from the fluid
15 feed device 6 through the first and second conduits 4 and 5.

16 Shown schematically in Figs. 2 and 3 is the construction of the
17 fluid supply channel selector means 7. In these figures, indicated at
18 10 is a mouth piece which is securely fixed to a casing 11 of the
19 manipulating head assembly 2 by a nut 12 to provide a fluid feed port

1 on the proximal side of the manipulating head assembly 2, that is to
2 say, on the side away from the front side to which the insertion tube 1
3 connected. The mouth piece 10 is provided with a first connecting
4 portion 13 in the form of a tube at its fore end to function as a
5 connection port for the first fluid conduit 4, and a second connecting
6 portion 14 in the form of a tube which is provided on a lateral side of
7 the mouth piece as a connection port for the second fluid conduit 5.
8 These connection ports 13 and 14 are both opened to an axial
9 receptacle bore 15 in the mouth piece 10. The receptacle portion 15 is
10 open on the outer side of the manipulating head assembly 2. Either a
11 fluid feed adaptor 20 or a closure plug member 30 of a resilient
12 material is detachably attached to the outer open end of the receptacle
13 portion 15.

14 The first connection port 13 is opened to a fore end portion of
15 the receptacle bore 15, while the second connection port 14 is opened
16 to a side portion of the receptacle bore 15. In this instance, the
17 diameter of the receptacle bore 15 is gradually reduced in the inward
18 direction, providing a reduced diameter portion 15a at the fore end in
19 communication with the first connection port 13 which is projected

1 inward continuously from the inner end of the mouth piece 10. On
2 the proximal side, the reduced diameter portion 13 is moderately
3 tapered to provide a Luer-Lok taper portion 15b. The second
4 connection port 14 is in communication with the Luer-Lok portion 15b
5 of the receptacle bore 15.

6 The fluid feed adaptor 20 to be detachably fitted in the
7 receptacle bore 15 of the mouth piece 10 has a construction as shown
8 in Fig. 2. More specifically, the fluid feed adaptor 20 is provided with a
9 tapered fore end portion 21 the circumferential surface of which is
10 tapered with a corresponding taper angle relative to the Luer-Lok taper
11 portion 15b of the receptacle bore 15, and a connector portion 22. The
12 tapered fore end portion 21 of the fluid feed adaptor 20 is inserted into
13 the receptacle bore 15 beyond and forward of a position where the
14 second connection port 14 is opened to the Luer-Lok taper portion 15b
15 of the receptacle bore 15. On the other hand, for example, the
16 connector portion 22 of the fluid feed adaptor 20 is arranged in a
17 shape suitable for connection of a fluid feed means like a syringe.
18 Therefore, the fluid feed adaptor 20 is provided with a Luer-Lok taper
19 surface 22a on its inner periphery, and a flange 22b at its outer

1 proximal end. When a syringe or a similar fluid feed means is
2 attached to the fluid feed adaptor 20, a fluid can be fed under pressure
3 from the fluid supply passage 23 to the first fluid conduit 4 which is
4 connected to the first connection port 13 of the mouth piece 10.

5 An external screw 10a is provided on the circumferential surface
6 of the mouth piece 10 on the outer side of the casing 11, for the
7 purpose of retaining in a stabilized state the fluid feed adaptor 20
8 which is attached to the mouth piece 10, and at the same time for the
9 purpose of holding in a hermetically closed state the second
10 connection port 14 which is opened to the Luer taper portion 15b. On
11 the other hand, a stopper ring 24 is threaded on an external screw on
12 provided on the fluid feed adaptor 20 in a transitional portion between
13 the fore tapered portion 21 and the connector portion 22, into abutting
14 engagement with outer end face of the mouth piece 10. The stopper
15 ring 24 is securely fixed in position on the fluid feed adaptor 20 by the
16 use of an adhesive or other suitable means. A screw ring 16 is
17 mounted between the stopper ring 24 and the flange portion 22b, in
18 threaded engagement with an external screw portion 10a of the mouth
19 piece 10. This screw ring 16 is provided with an inwardly turned

1 portion 16a at its outer end and thereby prevented from falling off the
2 fluid feed adaptor 20.

3 Thus, the fluid feed adaptor 20 can be attached to the mouth
4 piece 10 by tightening the screw ring 16 after inserting the tapered
5 fore end portion 21 of the fluid feed adaptor 20 into the Luer taper
6 portion 15b of the receptacle bore 15. Whereupon, the stopper ring 24
7 is pushed in by the stopper portion 16a of the screw ring 16 until the
8 tapered fore end portion 21 of the fluid feed adaptor 20 is brought into
9 intimate contact with the Luer taper portion 15b of the receptacle bore
10 15 of the mouth piece 10. As a result, the fluid feed adaptor 20 fixedly
11 attached to the mouth piece 10, hermetically closing the opening of
12 the second connection port 14. Even when the fluid feed adaptor 20 is
13 attached to the mouth piece 10, the closure plug member 25 is fitted
14 on the connector portion 22 as long as no fluid feed means is
15 connected thereto.

16 Shown in Fig. 3 is a plug member 30 to be attached to the
17 mouth piece 10 in place of the fluid feed adaptor 20. The plug member
18 30 is made of a resilient material like rubber, and provided with a
19 cylindrical main body portion 31 which is adapted to be pushed into

1 the receptacle bore 15 of the mouth piece 10 to a predetermined
2 degree, and a tubular fastening skirt portion 32 which is formed
3 around the cylindrical main body portion 31. Accordingly, the outer
4 open end of the receptacle bore 15 of the mouth piece 10 is closed
5 upon attaching the plug member 30 to the mouth piece 10. In the
6 Luer taper portion 15b of the receptacle bore 15, the main body
7 portion 31 of the plug member 30 is stopped at a position short of the
8 second connection port 14. As a consequence, the second connection
9 port 14 is communicated with the first connection port 13, and a fluid
10 from the second fluid conduit 5 is supplied to the first fluid conduit 4
11 and spurted out from the fluid jet injection port 4a at the fore distal
12 end of the insertion tube 1.

13 In the above-described conduit system, the plug member 30 is
14 fitted on the mouth piece 10 when no fluid is supplied from a syringe
15 on the side of the manipulating head assembly 2. It follows that,
16 unless the fluid feed device 6 is actuated, no fluid is supplied to the
17 first and second fluid conduits 4 and 5. If the pump of the fluid feed
18 device 6 is started in this state, a required fluid is fed to the second
19 fluid conduit 5 from the fluid feed device 6 under a rated pump

1 pressure and at a constant flow rate. Through the second connection
2 port 14, the fluid is allowed to flow into the receptacle bore 15 of the
3 mouth piece 10, and supplied to the first fluid conduit 4 from the first
4 connection port 13 to spurt a jet of a fluid, for example, a jet of
5 cleaning water into a body cavity for cleaning purposes. This sort of
6 operation can be carried out not only by an operator but also by a
7 nurse or assistant personnel on demand of an operator.

8 On the other hand, in case a syringe is used as a fluid supply
9 source, the plug member 30 removed from the mouth piece 10 and the
10 fluid feed adaptor 20 is attached to the mouth piece 10 before or after
11 introducing the endoscopic insertion tube 1 into a body cavity. In such
12 a case, a lid member 25 of resilient material is fitted on the connector
13 portion 22 of the fluid feed adaptor 20 to keep the outer open end of
14 the fluid feed adaptor 20 in a hermetically closed state until actually
15 starting supply of a fluid. Then, when it becomes necessary to supply
16 a fluid into a body cavity, the lid member 25 is removed from the fluid
17 feed adaptor 20 and instead a syringe is connected to the connector
18 portion of the fluid feed adaptor 20. Thus, a suitable amount of a fluid,
19 for example, a suitable amount of coloring agent can be sent into a

1 body cavity under a desired pressure and at a suitable time point
2 according to judgements of an operator.

3 After use, the first and second fluid conduits 4 and 5 of the
4 endoscope have to be washed clean. At the time of washing these
5 conduits, the fluid feed adaptor 20 and the plug member 30 are
6 removed from the mouth piece 10. The first and second fluid conduits
7 4 and 5 are joined through the mouth piece 10 but are separately
8 connected to the first and second connecting portions 13 and 14 of the
9 mouth piece 10. Besides, both of the first and second fluid conduits 4
10 and 5 have no branches or junction points so that they can be washed
11 easily and completely by the use of a brush or the like.

12 Turning now to Figs. 4 and 5, there is shown a second
13 embodiment of the present invention. In this embodiment, the first
14 and second fluid conduits 4 and 5 are joined together through a
15 junction pipe member which is provided within the casing of the
16 manipulating head assembly, preventing fluid flow into the second
17 fluid conduit 5 from the side of the first fluid conduit 4.

18 In Fig. 4, indicated at 40 is a first fluid conduit leading to a fluid
19 jet injection port at the fore distal end of the insertion tube of the

1 endoscope, and at 41 is a second fluid conduit which is connected to a
2 fluid feed device through the universal cable of the endoscope. These
3 first and second fluid conduits 40 and 41 are connected to first and
4 second connecting portions 42a and 42b of a junction pipe member
5 42, respectively. The junction pipe member 42 is further provided with
6 a third connecting portion 42c which is constantly in communication
7 with the first fluid conduit 40. Connected to the third connecting
8 portion 42c is one end of a communicating conduit 43 the other end of
9 which is connected from a mouth piece 50 provided on the rear side of
10 the manipulating head assembly of the endoscope. Accordingly, this
11 communicating conduit 43 constitutes part of the first fluid conduit 40,
12 and the other end which is connected with the mouth piece forms a
13 connecting end. The forked junction pipe member 42 is securely
14 anchored in position by a holder member 45 which is fixedly mounted
15 on a support plate 44 within a casing of the manipulating head
16 assembly.

17 As seen in Fig. 5, the mouth piece 50 is arranged in a manner
18 similar to the mouth piece 10 of the first embodiment shown in Figs. 2
19 and 3. The mouth piece 50 is provided with a connection port 51

1 which corresponds to the first connection port of the mouth piece 10,
2 but in this case the mouth piece 50 is not provided with a second
3 connection port at its side portion. Since the mouth piece 50 is
4 provided with a Luer taper portion 53 in its receptacle bore 52, a
5 syringe or a similar fluid feed means can be connected to the mouth
6 piece 50 directly or by way of a fluid feed adaptor 20 as shown in Fig.
7 2.

8 The second fluid conduit 41 is connected to the second
9 connecting portion 42b of the junction pipe 42 not directly but
10 through a reverse flow blocking or checking member 46. This reverse
11 flow checking member 46 is in a tubular pipe-like form having one end
12 thereof connected to the second fluid conduit 41 and the other end in
13 threaded engagement with the second connecting portion 42b of the
14 junction pipe member 42. Fitted internally of the reverse flow
15 checking member 46 is a check valve 47 which permits a fluid flow into
16 the junction pipe member 42 from the second fluid conduit 41, while
17 blocking a fluid flow into the second fluid conduit 41 from the side of
18 the junction pipe member 42.

19 With the arrangements as described above, it is possible to

1 control supply of a fluid in the same manner as in the first
2 embodiment. Namely, when the fluid feed adaptor 20 is connected to
3 the mouth piece 50 on a manipulating head assembly of an endoscope,
4 a necessary amount of a fluid, for example, a necessary amount of a
5 coloring agent can be send to the first fluid conduit 40 from a syringe
6 or a similar fluid feed means which is connected to the fluid feed
7 adaptor 20, and injected into a body cavity under a suitable pressure.
8 In so doing, reverse flow of the supplied fluid toward the second fluid
9 conduit 41 is prevented by the action of the check valve 47. Further,
10 when the plug member 30 of Fig. 3 is fitted on the mouth piece or
11 when the outer open end of the fluid feed adaptor 20 is closed with the
12 lid member 25, a fluid can be supplied to the second fluid conduit 41
13 by actuating a fluid feed device which is connected to a proximal end
14 portion of the universal cable. Whereupon, the check valve 47 is
15 pushed open by the supplied fluid pressure, and the fluid is supplied
16 to the first fluid conduit 40 from the junction pipe member 42 and
17 spurted into a body cavity from the fluid jet injection port at the distal
18 end of the endoscopic insertion tube. Of course, there is no possibility
19 of fluid leaks through the mouth piece 50 as long as it is closed with

1 the plug member.